highly magnified spectrum is gazed at steadily in the neighbourhood of D, or F, or G, the colours begin to change and flicker exactly as if some controlling mechanism were getting fatigued. But if either of the contending sensations is *thoroughly* exhausted, as in artificial colour-blindness, this flickering ceases, and is abolished until the retina recovers. I have called attention to the fact that the positive after-effect or dazzle-tint of artificial colour-blindness does not undergo those cyclic changes of colour which have been so long familiar in ordinary after-images.*

To sum up—

(1.) There appears to be strong evidence of the existence in the retina, between the structures in which the visual impulses originate and the beginnings of the optic nerve, of a set of structures by which the intensity of the visual impulses transmitted to the central organ is regulated.

(2.) That these structures are sensitive to light, and when excited block wholly or in part visual impulses coming from the periphery.

(3.) That these structures are cross-connected so that the excitation of one affects those in its neighbourhood, thus increasing the contrast between a bright object and its surroundings, and probably preventing the blurring of an image by diffused light from the retina.†

(4.) That they may by sudden stimuli be excited to a very powerful or even a multiple response.

(5.) That many phenomena of contrast and of areal induction may be accounted for on such a hypothesis.

(6.) That Dr. Shelford Bidwell's experiments are explicable without assuming a white sensation.

"Further Observations on Nova Persei. No. 4." By Sir NORMAN LOCKYER, K.C.B., F.R.S. Received October 10, 1901.

The last paper‡ contained an account of the observations of the Nova made at Kensington between March 25 and May 7. The observations are, in the present paper, brought up to September 30. Between June 18 and August 8 no work was done on the Nova, owing chiefly to the interference of buildings and twilight.

* 'Phil. Trans.,' B, vol. 191, p. 7.

† I find no evidence of any such cross-connection between one colour sensation and another.

‡ 'Roy. Soc. Proc.,' vol. 68, p. 399.

Magnitude.

The magnitude has been estimated on sixteen evenings. These seem to afford sufficient evidence that since the beginning of May the star has decreased in magnitude from about 5·7 to 6·7; further, the short variations previously recorded apparently no longer exist, as the estimated magnitudes on eleven nights since the end of August only vary between 6·5 and 6·8.

Photographs of the region about the Nova were taken with the 6-inch Dallmeyer doublet on the evenings of August 25 and September 11, 12, and 18. From these it has been ascertained that its magnitude relatively to those of the surrounding stars is greater photographically than visually.

Visual Spectrum.

The spectrum has been observed with a McClean direct-vision spectroscope on the evenings of August 8, 13, 17, 20, 22, 24, and September 11, 12, 18. The line in the position of the chief nebular line at λ 5007 has always been noted as being the strongest, Hβ and the line at λ 4959 being also present, but comparatively much weaker. Fairly bright lines near λ 472 and the region of Hγ have also been recorded. Traces of a few lines less refrangible than λ 5007 have been glimpsed, but no determinations of their wave-lengths have been made. No lines have been observed in the yellow or red regions of the spectrum.

Photographic Spectrum.

Photographs have been taken on the evenings of August 9, 15, 17, 21, 22, 23, 24, 26, September 3, 5, 9, 10, 11, 12, 18, 21, 23, 25, 26, with the 9-inch prismatic reflector, the Nova being now far too faint for the utilisation of the 6-inch objective prism, and, until quite recently, in such a position as to make the 30-inch reflector unavailable. These photographs show little or no variation amongst themselves either in the number, position, or relative intensities of the lines. The scale of the photographs is such that the distance between Hβ and Hϵ is about 0·9 cm. The wave-lengths of the lines have been determined from the best photograph (August 26) by means of an interpolation curve. The presence in the Nova spectrum of some of the hydrogen lines and the helium line λ 4471 was established by direct comparison with the spectra of other stars photographed with the same instrument. These lines were used, together with the 5007 line (the identity of which with the strongest nebula line was assumed), as fiducial lines for the construction of the interpolation curve. The remaining lines were then measured and their wave-lengths read off from the curve. The intensities of the lines as they appear on the plate were also noted.

The spectrum has undergone great modification since the last photographs were taken at Kensington in March and April. The lines are about the same in number and position, but their nature and relative intensities have vastly changed. In the latter part of March and the early part of April the lines were generally broad and ill-defined. They are now narrower, and with better defined edges. The greatest change noticeable in the spectrum is with respect to the relative weakening of the hydrogen lines generally and the alteration in relative intensity amongst some of them. In the earlier photographs the hydrogen lines were very prominent, and the individual members of the series gradually weakened as the ultra-violet part of the spectrum was approached. In the latest photographs they appear of quite secondary importance. Hβ, Hγ, and Hδ are all present, but occur only as comparatively weak lines, especially the latter two. With regard to Hϵ, apparently the only other hydrogen line shown, the case is different. The line at or near the position of Hϵ is now about the second strongest line in the whole photographic spectrum, and many times stronger than either Hδ, Hγ, or Hβ. With this fact in view, it may be suggested that this strong line is possibly not wholly due to hydrogen, but is mainly a new line of unknown origin, which happens to fall exactly on, or very near to, the position of Hϵ. The line appears to be of much the same nature as the stronger adjacent line at λ 3868. The following table gives the wave-lengths and intensities of the lines visible in the photographs:—

$\lambda\lambda$.	Int. (max. = 10).	Remarks.
3868	10	Strong line in spectrum of planetary nebulæ.
3970	8	Probably not wholly due to hydrogen (Hϵ), intensity abnormal.
4102	2	Hδ.
4341	2	Hγ.
4364	7	
4471	1	Helium.
4636	3	
4684	2	Probably identical with 4687 of ζ Puppis and Orion stars.
4720	6	
4808	<1	
4862	3	Hβ.
4959	2	Apparently identical with second nebula line.
5007	4	„ „ strongest „

In addition to the lines in the above table, six of the photographs, including that of August 26, give indications of the presence of a line in the extreme ultra-violet. Its wave-length could not be obtained

with any degree of accuracy owing to lack of comparison photographs showing lines in the same part of the spectrum, but it is probably identical with the line at λ 342 which von Gothard has independently recorded.*

The enhanced lines of iron, magnesium, &c., which were such a conspicuous feature of the earlier photographs of the Nova spectrum, have now entirely disappeared, and the probability is that the bright lines of the present spectrum other than those of hydrogen and helium belong to gases the terrestrial equivalents of which have not been found. It may be mentioned, however, that in their paper "On the Spectrum of the more Volatile Gases of Air,"† Professors Liveing and Dewar record weak lines at λλ $\frac{4363}{4365}$ and 4636 which may possibly have the same chemical origin as the Nova lines 4364 and 4636.

As there is no indication of the new lines forming a series similar to those given by hydrogen and helium, there is probably more than one gas involved.

Characteristics of the Hydrogen and other Lines.

In the series of photographs under discussion, the hydrogen lines no longer exhibit the curious structure described in previous communications, but are much fainter and rather narrower and devoid of any apparent differences in density. Some of the bright lines—notably λ 3868 and λ 3970—are of about the same width as the adjacent hydrogen lines were in the earlier photographs, and show a structure somewhat similar to that illustrated in a previous note.‡

The lines in question appear as triplets, and in each case the most refrangible member is slightly brighter than the others. The lines at λ 4364 and λ 4720 are narrower and less intense than those just mentioned, and put on the appearance of doubles, the brighter members being still on the more refrangible side.

Appearance of the Star.

Visual examination of the star under high powers shows that the Nova has a decidedly larger disc than is possessed by neighbouring stars of similar magnitude. Photographs of the region of the Nova taken on the nights of September 11 and 12, 1901, with a Dallmeyer rectilinear objective of 6 inches aperture and focal length of 4 feet 6 inches, show the penumbral aureole very clearly. It has a fairly definite outline, and is altogether different in character from the

* 'Astro. Nach.,' No. 3738.
† 'Roy. Soc. Proc.,' vol. 67, p. 467.
‡ 'Roy. Soc. Proc.,' vol. 68, p. 234.

images of neighbouring stars of equal magnitude. This peculiarity of the Nova's disc was first remarked by Flammarion and Antoniadi, and later by Max Wolf, Kostinsky, and von Gothard. It owes its origin probably to the exceptionally strong ultra-violet rays emitted by the Nova, which are not brought to the focus for which the objective is corrected.

The recent photographs have been taken by Mr. Butler and Mr. Rolston. The visual observations have chiefly been made by Messrs. Fowler and Butler. Mr. Baxandall has undertaken the reduction to wave-lengths and the discussion of the lines in the photographic spectrum, while Dr. Lockyer and Mr. Baxandall have assisted in the preparation of the present paper.

"An Attempt to ascertain the Date of the Original Construction of Stonehenge from its Orientation." By Sir NORMAN LOCKYER, K.C.B., F.R.S., and F. C. PENROSE, F.R.S. Received October 21, 1901.

This investigation was undertaken in the spring of the present year, as a sequel to analogous work in Egypt and Greece, with a view to determine whether the orientation theory could throw any light upon the date of the foundation of Stonehenge, concerning which authorities vary in their estimate by some thousands of years. We beg to lay before the Royal Society the results derived from a careful study of its orientation for the purpose of arriving at the probable date of its foundation astronomically. This is not, indeed, the first attempt to obtain the date of Stonehenge by means of astronomical considerations. In Mr. Godfrey Higgins' work* he refers to a method of attack connected with precession. This furnished him with the date 4000 B.C.

More recently, Dr. W. M. Flinders Petrie,† whose accurate plan is a valuable contribution to the study of Stonehenge, was led by his measures of the orientation to a date very greatly in the opposite direction, but, owing to an error in his application of the change of obliquity, clearly a mistaken one.

As the whole of the argument which follows rests upon the assumption of Stonehenge having been a solar temple, a short discussion of the grounds of this view may not be out of place; and, again, as the approximate date which we have arrived at is an early one, a few words may be added indicating the presence in Britain at that time of a race of men capable of designing and executing such work.

* 'The Celtic Druids.' 4to. London, 1827.

† 'Stonehenge,' &c., 1880.